

# A PLANT ECOLOGICAL RECONNAISSANCE OF THE UPPER MGENI CATCHMENT†

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## INTRODUCTION

The following account is a summary of a plant ecological study undertaken in 1964. The full report was submitted as a thesis for the M.Sc. Degree (Moll, 1965) in the Botany Department, University of Natal, Pietermaritzburg.

The Upper Mgeni Catchment, an area of approximately 330 square miles (845 square kilometres), is 15 miles (25 km) northwest of Pietermaritzburg (Fig. 1).

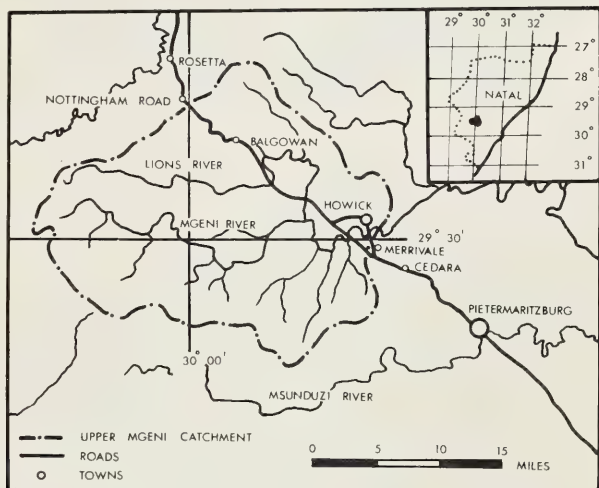


Fig.1. Location and drainage pattern of the Upper Mgeni Catchment, insert shows this area in Natal.

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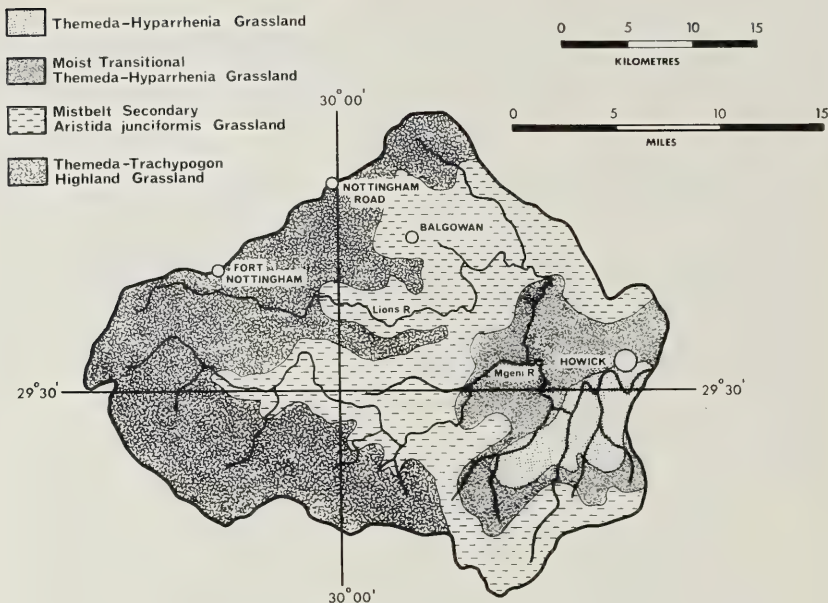


Fig. 2. The vegetation of the Upper Mgeni Catchment.

Four major vegetation types were distinguished in the area (Fig. 2), and their nomenclature follows that of Edwards (1967). Aspect and altitude were important factors in determining the extent of the vegetation types, which were as follows:—

- (i) *Themeda-Hyparrhenia* Grassland, covering approximately 21 square miles (54 square kilometres), below 3,500 ft. (1,069 m).
- (ii) Moist Transitional *Themeda-Hyparrhenia* Grassland covering approximately 42 square miles (108 square kilometres), between 3,000 and 4,000 ft. (914 and 1,219 m).
- (iii) *Themeda-Aristida* Grassland and Mistbelt Mixed *Podocarpus* Forest, covering approximately 112 square miles (287 square kilometres), between about 4,000 and 4,500 ft. (1,219 and 1,372 m).
- (iv) *Themeda-Trachypogon* Grassland and Mountain *Podocarpus* Forest, covering approximately 155 square miles (497 square kilometres), above about 4,500 ft. (1,372 m).

## GEOMORPHOLOGY AND SOILS

The geology of the area is simple, comprising near horizontal beds of sedimentary rocks of the Karoo System (du Toit, 1954). Ubiquitous in the area are innumerable dolerite dykes and sills, resulting in many boulder-strewn areas. The dolerite, being harder than the surrounding matrix, gives rise to such topographic features as hills and waterfalls.

The topography of the area (Fig. 3) is a series of rolling, grass-covered hills with occasional steep valleys and broad flat plains (Plate 1). The area is drained by the Mgeni and Lions Rivers which rise in large, permanent vleis above 4,000 ft. (1,219 m). Almost continuous terracettes (King, 1951), resembling contour paths, are a conspicuous feature of the steep grass-covered slopes.

Little data on the soils of the area were available, but, by extrapolation (van der Eyk in Edwards, 1967), the soils of the *Themeda-Hyparrhenia* Grassland type were considered partly leached types, whereas the remaining soils represent highly leached types.

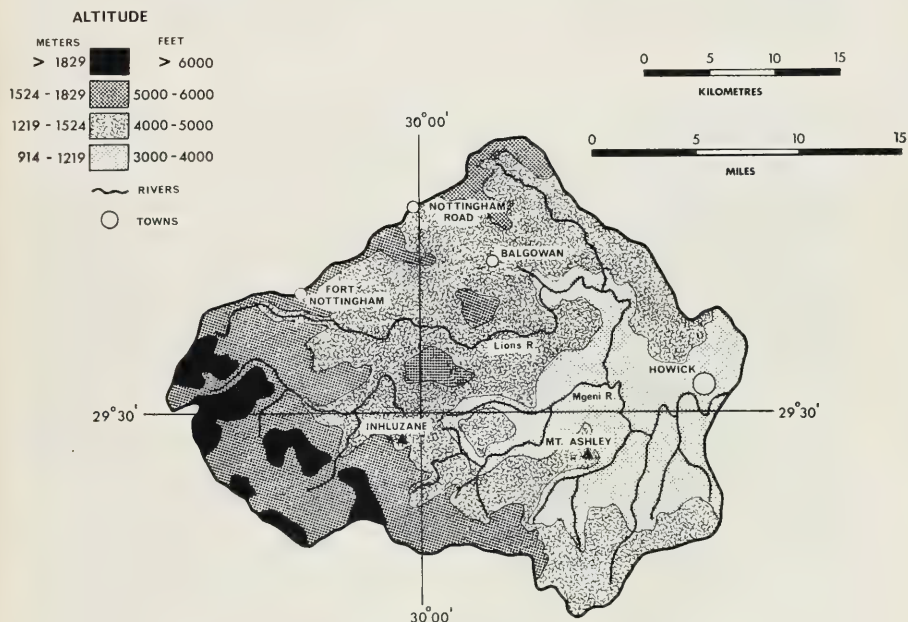


Fig. 3. Topographic map of the Upper Mgeni Catchment.



PHOTO 1. Looking north over the rolling, grass-covered hills and the flat river valleys.

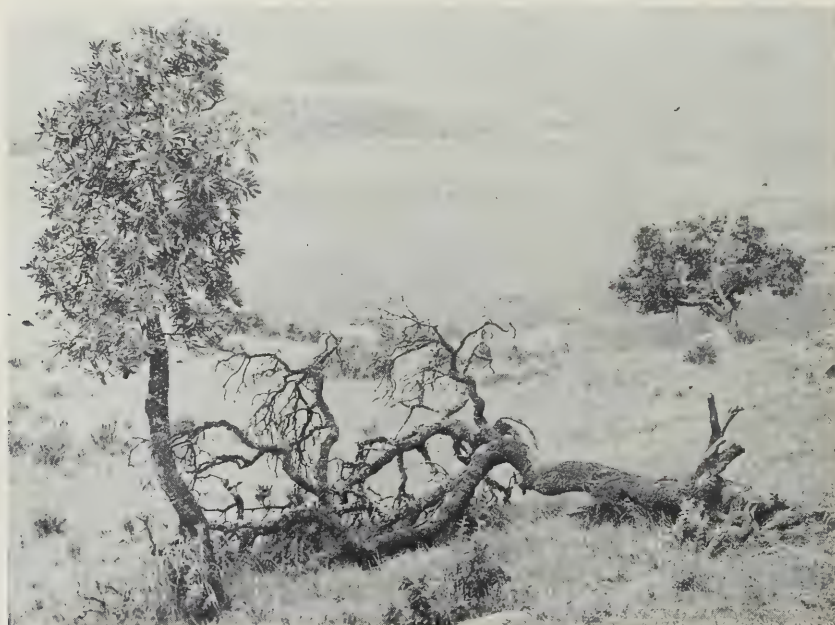


PHOTO 2. A wind-blown *Protea multibracteata*. Note that only two old trees remain and that there is no sign of any young trees.



# CLIMATE

1. *Insolation.* The north-facing slopes are warmer, and consequently drier, than the cooler, more moist, south-facing slopes. This is illustrated by the presence of forest species on the south-facing slopes and their absence on north-facing slopes, except where there is additional soil moisture from springs.
2. *Temperatures.* Generally, the temperatures of the area are mild, averaging 13 to 16°C for the year. However, it is the extreme temperatures that are significant. Severe frost may occur throughout the Catchment (Weather Bureau, 1942 and 1954), while the highest maximum temperature recorded is a little above 40°C.
3. *Wind.* The southerly winds bring rain and fog during summer (October to March). Berg winds, which occur mainly from June to September, blow from the northwest and are hot and dry (Tyson, 1964). They occur at a time of year when the water stress for the vegetation is greatest. Winds may also cause some mechanical damage to woody species, occasionally uprooting trees and breaking branches (Plate 2).

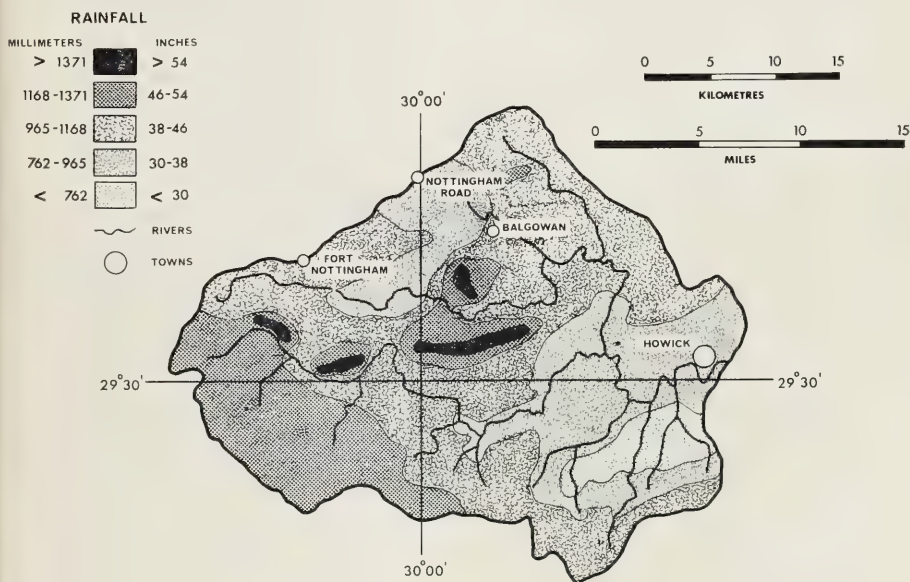


Fig. 4. Mean annual rainfall in the Upper Mgeni Catchment.

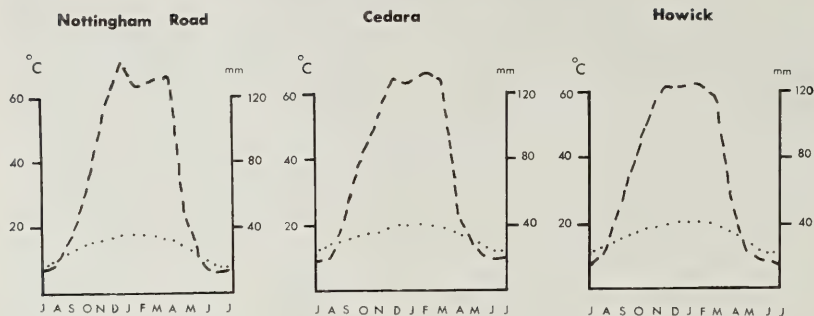


Fig. 5. Climatographs showing duration and intensity of wet and dry periods for three stations (dotted line is temperature; dashed line rainfall).

4. *Precipitation.* The Upper Mgeni Catchment is in the summer rainfall area. Data of mean annual rainfall from 37 stations (Rainfall Normals, 1939; Weather Bureau, 1954; and local farm records) were plotted onto a map and give some indication of the rainfall pattern over the area (Fig. 4). The catchment can be divided into four rainfall regions, which correspond remarkably well with the vegetation types.

Fog is an important source of precipitation as evidenced by the occurrence of forest patches on those slopes receiving most fog.

Hail, although only occurring occasionally, can be exceedingly destructive, causing extensive damage to woody plants in particular.

Snow occurs regularly once or twice a year above 5,000 ft. (1,524 m), but is fairly rare below this level. Snow is important as it brings moisture in an otherwise dry period. It also causes considerable mechanical damage to woody vegetation, particularly forest.

5. *Interaction of rainfall and temperature.* The diagrammatic method of Walter (1953) for plotting rainfall and temperature data provides an effective means of assessing intensity and duration of wet and dry periods. These diagrams show that all three stations have a mildly dry winter and a moist summer.

#### HISTORICAL BACKGROUND

An appreciation of the history of an area assists in interpreting the current vegetation patterning. The most important factors affecting the vegetation of the Upper Mgeni Catchment are the use of fire, and land utilization.

It is considered that fire in early spring was a natural factor (Bayer, 1953). But, with the settlement of the land autumn burning was initiated, resulting in

a change in grassland composition from mainly *Themeda*, to *Aristida* Grassland.

The system of land-use changed from extensive to semi-intensive as the country became settled by the Europeans. With man came his domestic stock which are selective grazers, choosing the palatable grasses such as *Themeda* and leaving the unpalatable species such as *Aristida*. This, therefore, had the same effect as autumn burning.

Since 1838 the indigenous forests have been exploited for their timber and most large trees have been removed from the forest patches.

## THE VEGETATION

### 1. SERAL VEGETATION

#### 1.1. *The Hydrosere*

1.1.1. *Vlei hydrosere*. Vleis, or marshy areas with a fluctuating water level, are most common above 4,500 ft. (1,372 m) where some are 100 acres (40 hectares) and more in area. In the larger vleis surface water is usually perennial (Plate 3), and in the wet season, when the water level rises, a much larger adjacent flat area is inundated.

Around most vleis there is a fairly distinct zonation of plant communities:

(a) Submerged aquatics are found where there are perennial pools. Common algae are species of *Spirogyra*, *Zygnema*, *Nitella* and *Cladophora*. The only submerged aquatic angiosperm found was *Lagarosiphon muscoides*.

(b) Partially submerged aquatic plants are the most common type. Dominant species are tussock and rhizomatous, perennial sedges and grasses, from two to four feet (0.6 to 1.2 m) high, such as *Scirpus fluitans*, *Cyperus denudatus*, *Carex* spp., *Leersia hexandra* and *Juncus exertus*. Occasionally, local consociates of *Phragmites communis*, up to nine feet (2.7 m) high, also occur. Other herbaceous plants are *Mentha aquatica*, *Geranium incanum*, *Cerastium arabis* and *Polygonum salicifolium*.

(c) The next community, on the outward zonation of vlei vegetation, is Sedge-Meadow. This is the most extensive community occurring on the area flooded in summer. Dominant plants are tussock and rhizomatous sedges up to three feet (0.9 m) high. In some areas certain grass species are also found. Common species are *Pycnus flavescens*, *P. macranthus*, *P. oakfortensis*, *Juncus effusus*, *J. oxycarpus*, *Scirpus macer*, *S. muricinux*, *Scleria welwitschii*, *Beckeropsis uniseta*, *Festuca caprina*, *Kyllinga melanospora*, *Fuirena pubescens*, *Pennisetum sphacelatum*, *Rhynchospora glauca*, *Fingerhuthia sesleriaeformis*, *Hemarthria altissima* and *Bulbostylis schoenoides*. In addition, there are numerous associated herbaceous species such as *Gerbera natalensis*, *Ranunculus multifidus*, *Senecio caudatus*, *Helichrysum* spp., *Urginea macrocentra*, *Verbena bonariensis*, *Kniphofia buchananii*, *Anoeganthus breviflorus*, *Aponogeton junceus*, *Limosella africana*,





PHOTO 3. A large vlei with perennial water, fringed by partly submerged aquatics, such as *Scirpus fluitans* (rear) and *S. corymbosus* (sides and foreground.)



PHOTO 4. *Phragmites communis* forming a narrow fringe along a stream bank.



*Diclis reptans*, *Scilla* spp., *Trifolium* spp., *Drosera burkeana*, *Rhodohypoxis* spp., *Utricularia livida* and *Lobelia* spp.

(d) Between the Sedge-Meadow and the surrounding grassland there is sometimes a narrow zone of hygrophilous grasses. Common species are *Festuca caprina*, *Tristachya hispida*, *Poa binata*, *Koeleria cristata*, *Paspalum* spp., *Imperata cylindrica* and *Andropogon eucomis*. The last two usually occur on poorly drained soils.

1.1.2. *Stream Hydrosere*. Most streams are swiftly flowing and subject to frequent flooding, due to the seasonal nature of the rainfall. The boundaries between aquatics and the fringing vegetation are sharply defined, because of the rapid decrease in soil moisture content away from streams (Plate 4).

The zonation of plant communities is often indistinct, but the following types can be distinguished:—

(a) Submerged aquatics are mainly algae such as *Oedogonium* and *Batrachospermum*. Angiosperms, such as *Potamogeton pusillus* and *Lagarosiphon muscoides*, are rare. On rocks in rapids and waterfalls the highly specialized *Hydrostachys natalensis* thrives.

(b) Partly submerged aquatics are poorly represented, the most common being *Leersia hexandra*, *Scirpus fluitans*, *Cyperus textilis*, *Polygonum* spp., *Phragmites communis* and *Potamogeton thunbergii*.

(c) The stream bank communities below 4,000 ft. (1,219 m) comprise woody plants such as *Combretum erythrophyllum*, *Salix woodii*, *Diospyros lycioides* and *Acacia ataxacantha*, and may form patches of dense riverine bush up to 25 ft. (7.6 m) high. Above 4,000 ft. (1,219 m) *Leucosidea sericea*, *Passerina montana*, *Salix woodii*, *Diospyros lycioides*, *Cyathea dregei* and *Erica caffrorum* often form a scattered community 10 to 15 ft. (3.0 to 4.6 m) high.

Herbaceous species are similar throughout, the commonest being *Miscanthidium junceum*, *Phragmites communis*, *Kniphofia laxiflora*, *Juncus exertus* and *Zantedeschia aethiopica*. Above 4,500 ft. (1,372 m) additional species such as *Danthonia macowanii*, *Moraea spathulata* and *Gunnera perpensa* occur.

## 1.2. *The Lithosere*

1.2.1. *Succession on dry rock*. Initial invaders are crustose and foliose lichens. Higher plants are only able to invade these areas once there is sufficient soil for their roots. The soil usually accumulates in cracks and depressions. Common pioneers are *Pellaea viridis*, *Aristida junciformis*, *Rhynchelytrum setifolium*, *Heteropogon contortus*, *Rendlia altera* and *Michrochloa caffra*.

1.2.2. *Succession on moist rock*. On moist rock several seral stages can be recognized. Initial invaders are lichens, blue-green algae and bryophytes. The



PHOTO 5. One of the grass mats, comprised of *Styppeichloa gynoglossa* and *Andropogon filifolius*, rolled back to show the mass of interlocked fibrous roots. The fern on the left is *Pellaea viridis*.



PHOTO 6. *Moraea spathulata* is one of the most common associated herbaceous species in the *Themeda-Trachypogon* Grassland.

next stage in the succession is the invasion of these pioneer communities by *Selaginella dregei* and other mat-forming angiosperms, such as *Rendlia altera*, *Michrochloa caffra*, *Bulbostylis caricoides*, *Styppeiochloa gynoglossa* and *Andropogon filifolius* (Plate 5). Numerous other herbaceous species invade these mats. In the wetter areas Sedge-Meadow species are common, and, in drier areas, common species are *Thesium costatum*, *Cyperus rupestris*, *Eragrostis racemosa*, *Scirpus falsus*, *Elyonurus argenteus*, *Euphorbia gueinzii*, *Brachystelma pygmaeum*, *Euryops dyeri*, *Hypoxis* spp., *Scilla* spp., *Crassula ramuliflora*, *Fimbristylis* spp., *Tulbaghia* spp., *Wurmbea kraussii* and *Zaluzianskya pulvinata*.

1.2.3. On dolerite outcrops the soil between the boulders is fairly deep, supporting a good grass cover. The dominant species is *Themeda triandra*. Other associated species are *Tristachya hispida*, *Andropogon filifolius*, *Harpachloa falx*, *Elyonurus argenteus*, *Festuca costata*, *Heteropogon contortus*, *Helictotrichon turgidulum*, *Cymbopogon validus*, *Aristida junciformis* and *Hyparrhenia hirta*. The last two species are characteristic of secondary disturbance. Common associated herbs are *Veronia hirsuta*, *Rhynchosia minima*, *Gladiolus* spp., *Senecio* spp., *Dierama* spp., *Lotononis corymbosus*, *Scilla natalensis*, *Gerbera natalensis*, *Acalypha peduncularis*, *Aster* spp., *Watsonia meriana*, *Helichrysum* spp., *Vigna vexillata*, *Pelargonium* spp., and *Nemesia* spp.

Where the boulders offer protection from fire, woody species such as *Passerina montana*, *Erica caffrorum*, *Asparagus* spp., *Athanasia acerosa*, *Rubus ludwigii* and *Chrysocoma tenuifolia* grow.

## 2. CLIMAX VEGETATION

Two main climax vegetation types are represented.

### 2.1. Grassland communities

Grassland is the most extensive community in the Upper Mgeni Catchment, covering approximately 85% of the total area. However, over most of the area the average annual rainfall exceeds 900 mm, sufficient, in the absence of fire, to support a forest climax. Fire halts the succession at the grassland stage.

#### 2.1.1. Primary Grassland

The following primary grassland types are found:—

##### (a) *Themeda-Hyparrhenia* Grassland

The *Themeda-Hyparrhenia* Grassland is equivalent to the Tall Grassland of Pentz (1945) and the Southern Tall Grassveld of Acocks (1953). It occupies approximately 21 square miles (53 square km), below 3,500 ft. (1,069 m), and is confined to the relatively dry Merrivale Basin south of the Midmar Reservoir. The country is fairly flat and a characteristic feature is the presence of widely



scattered, flat-topped *Acacia sieberana* trees up to 30 ft. (9 m) high, though many have been felled.

The average rainfall is less than 860 mm a year and the average temperature is about 16.0° C. Soils vary from unleached to partly leached types.

Three strata are represented and important species of the upper stratum are *Themeda triandra* and *Hyparrhenia hirta* which form a dense community about four feet (1.2 m) high, sometimes with *Cymbopogon plurinodis* being locally common. Mid-stratum grasses are *Tristachya hispida*, *Eragrostis capensis*, *E. curvula*, *Heteropogon contortus* and *Brachiaria serrata* which form an almost continuous layer about two feet (0.6 m) high. In addition, *Eragrostis racemosa* and *Cynodon dactylon* form a discontinuous layer of short grasses less than one foot (0.3 m) high.

(b) *Moist Transitional Themeda-Hyparrhenia Grassland*

In the Upper Mgeni Catchment there is a fairly large ecotonal area between the upper boundary of the *Themeda-Hyparrhenia* Grassland and the lower boundary of the *Themeda-Aristida* Grassland, at between 3,000 and 4,000 ft. (914 and 1,219 m) altitude. This area is occupied by the Moist Transitional *Themeda-Hyparrhenia* Grassland and is approximately 42 square miles (106 square km) in extent.

The average annual rainfall is between 760 and 960 mm and the soils are partly leached to leached.

The grassland is of mixed composition. The most common species are *Themeda triandra* and *Hyparrhenia hirta*. Other fairly common species are *Tristachya hispida*, *Eragrostis capensis*, *E. racemosa*, *E. curvula*, *Sporobolus capensis*, *Aristida junciformis*, *Monocymbium ceresiiforme*, *Harpechloa falx* and *Heteropogon contortus*.

On rocky slopes, where there is greater protection from fire, *Aloe candelebrum* Savanna may develop. Other associated woody plants are *Greyia sutherlandii*, *Ziziphus mucronata*, *Ehretia rigida*, *Maytenus heterophylla*, *Cussonia spicata* and *Rhus pentheri*.

(c) *Themeda-Aristida Grassland*

The *Themeda-Aristida* Grassland is equivalent to the Grassland of the Temperate Forest Region of Pentz (1945), and Acocks's (1953) *Themeda* Veld of the Natal Mistbelt. It is one of the two most extensive grassland communities in the area, occupying approximately 112 square miles (290 square km) between 4,000 and 4,500 ft. (1,219 and 1,372 m). The terrain is fairly rugged, the mean annual rainfall exceeds 960 mm, and the soils are leached.

Two strata are represented and the commonest species in the upper continuous layer, which is about two feet (0.6 m) high, are *Themeda triandra* and *Aristida junciformis*. Other species are *Tristachya hispida*, *Monocymbium ceresiiforme*, *Harpechloa falx*, *Eragrostis capensis*, *Trachypogon spicatus*,



*Andropogon amplexans*, *A. filifolius*, *Alloterospis semialata*, *Festuca scabra*, *F. caprina*, *Panicum ecklonii*, *Loudetia simplex*, *Heteropogon contortus* and *Setaria nigrirostris*. The species *Rendlia altera*, *Eragrostis racemosa* and *Microchloa caffra* form a discontinuous lower stratum.

(d) *Themeda-Trachypogon* Highland Grassland

The *Themeda-Trachypogon* Highland Grassland is equivalent to the Highland Sourveld of Pentz (1945) and Acocks (1953). It is the most extensive community in the area occupying approximately 155 square miles (401 square km.), above 4,500 ft. (1,372 m). The country is fairly flat, the mean annual rainfall exceeds 960 mm, and the soils are highly leached.

Two strata are represented and the dominant species in the upper continuous layer, which is about two feet (0·6 m) high, are *Themeda triandra* and *Trachypogon spicatus*. Other fairly common species are *Tristachya hispida*, *Monocymbium ceresiiforme*, *Andropogon amplexans*, *A. filifolius*, *Festuca scabra*, *F. caprina*, *F. costata*, *Loudetia simplex*, *Sporobolus centrifugus* and *Danthonia stricta*. A short, discontinuous, lower stratum is formed by *Eragrostis racemosa*, *Microchloa caffra*, *Rendlia altera* and *Stiburus alopecuroides*.

In a few isolated areas *Protea multibracteata* Savanna occurs, but this relic community shows little sign of regeneration.

Numerous forbs also grow in the grassland and these may be rare, or locally common, constituents (Plate 6). Most species flower in spring and early summer, their evolutionary development being related to fire and grass competition (Bews, 1918; Bayer, 1953). The majority are thus geophytes and hemicryptophytes, their buds below, or at, the soil surface escaping fire-damage.

The species involved are numerous and many belong to the families Cyperaceae, Liliaceae, Amaryllidaceae, Iridaceae, Orchidaceae, Leguminosae, Euphorbiaceae, Labiatae, Acanthaceae, Rubiaceae and Compositae.

### 2.1.2. *Secondary Grassland*

Most of the grassland in the Upper Mgeni Catchment is secondary, due to cultivation and to recent veld management practices. The following secondary communities occur:—

(a) *Aristida junciformis* Grassland, between 4,000 and 4,500 ft. (1,219 and 1,372 m), has resulted from autumn, or early winter, burning and selective grazing (Plate 7).

(b) *Hyparrhenia hirta* Grassland, below 4,000 ft. (1,219 m), is a consequence of selective grazing, veld disturbance and old cultivation.

(c) *Eragrostis-Sporobolus* Grassland occurs throughout the area, usually in small isolated patches where there has been excessive trampling.

(d) *Festuca costata* Grassland, above 5,000 ft. (1,524 m), occurs in isolated patches where there has been continuous grazing by sheep and annual winter burning.



PHOTO 7. Selective grazing and autumn burning results in the invasion of the grassland by *Aristida junciformis*.



PHOTO 8. Fire damage to Mountain *Podocarpus* Forest.

- (e) *Athanasia acerosa* Scrub, between 4,500 and 5,500 ft. (1,372 and 1,674 m), is found in isolated areas where in the past the veld was overgrazed by sheep.
- (f) *Rubus cuneifolius* Scrub is found throughout the area in small patches where the seed has been deposited by birds or man. It is a vigorous plant that is increasing in extent.
- (g) *Cynodon dactylon* Grassland is found in areas where stock congregate, possibly a combined trampling, and increased nitrogen content effect.

## 2.2. Forest communities

Forest is the climatic climax vegetation between 4,000 and 6,000 ft. (1,219 and 1,829 m) and usually occurs in patches on mesic, steep, south-facing slopes. These patches have been exploited for timber since 1838, mainly for *Podocarpus* spp. This exploitation, combined with the destruction of the forest margins by grass fires (Plate 8), has caused the forests to diminish rapidly in size.

### 2.2.1. Seral woody forest communities

Seral woody forest communities only develop where there is some protection from fire (Plate 9). Post-grassland stages are represented by tall grass and shrub communities, such as:

- (i) *Hyparrhenia* Mixed Tall Grassland Communities. *Hyparrhenia aucta* and occasionally *Cymbopogon* spp. or *Miscanthidium capense*, are the usual tall tussock grass species, with *Leonotis leonurus*, *Pteridium aquilium*, *Veronica corymbosa*, *Rubus ludwigii*, *Watsonia densiflora* and *Dierama pendula* being associated herbs.

Where there is some measure of protection from fire, woody plants, such as *Leucosidea sericea*, *Buddleia salviifolia* and *Maytenus heterophylla*, are able to invade.

- (ii) *Leucosidea sericea* Scrub. This scrub is usually found above 4,500 ft. (1,372 m) on moist soils along river banks, in damp depressions and on boulder-strewn slopes. The community comprises a pure stand of *Leucosidea* and may be fairly open or very dense.

- (iii) *Mixed Woody Communities*. These are particularly common on forest margins and, in the ectone region of the Moist Transitional *Themeda-Hyparrhenia* Grassland, on fire protected sites. Below 4,000 ft. (1,219 m) common tree species, up to 35 ft. (10·6 m) high, are *Ochna atropurpurea*, *Canthium mundianum*, *Ziziphus mucronata*, *Brachylaena elliptica*, *Dais continifolia*, *Maytenus heterophylla*, *Hippobromus pauciflorus*, *Cassine* spp., *Rhus pentheri* and *Cussonia spicata*. Above 4,000 ft. (1,219 m) common tree species are *Buddleia salviifolia*, *Leucosidea sericea*, *Heteromorpha trifoliata* and *Choristylis rhamnoides*.

Lianes such as *Dalbergia obovata*, *Capparis transvaalensis*, *Rhoicissus*





PHOTO 9. *Leucosidea sericea* (left) and *Podocarpus latifolius*, which are forest species, are able to grow on sites protected from fire in the *Themeda-Trachypogon* Grassland.



PHOTO 10. The mosaic of tree canopies gives an indication of the mixed nature of Mixed Mistbelt *Podocarpus* Forest.



*tridentata*, *R. rhomboidea*, *R. tomentosa*, *Acacia ataxacantha*, *Senecio* spp., *Scutia myrtina* and *Combretum* sp. nov., are fairly common in this community, particularly below 4,500 ft. (1,372 m), and are important as they increase the density of shade.

The effect of these seral communities is to provide a habitat suitable for the invasion of climax forest tree species. Some of the first to invade are *Cryptocarya woodii*, *Rapanea melanophloeos*, *Scolopia zeyheri*, *Halleria lucida*, *Podocarpus latifolius*, *Maytenus acuminata*, *Vepris undulata*, *Apodytes dimidiata*, *Fagara davyi*, *Trimeria rotundifolia*, *Pittosporum viridiflorum* and *Allophylus dregeanus*.

### 2.2.2. Climax forest

Two relatively distinct climax forest types occur in the area.

(a) Mistbelt Mixed *Podocarpus* Forest occurs in patches on south-facing slopes, in the *Themeda-Aristida* Grassland region. The species composition is very mixed and the canopy height varies from 45 to 70 ft. (14 to 21 m) and the forest has five strata (Plate 10). Structure is best shown by a profile diagram (Fig. 6). The upper closed canopy is occasionally pierced by taller growing, emergent species from 70 to 100 ft. (21 to 30 m) high. Species include *Cussonia chartacea*, *Cryptocarya myrtifolia*, *Podocarpus falcatus* and *Ptaeroxylon obliquum*. Common canopy species, which are 45 to 70 ft. (14 to 21 m) high, are *Calodendrum*

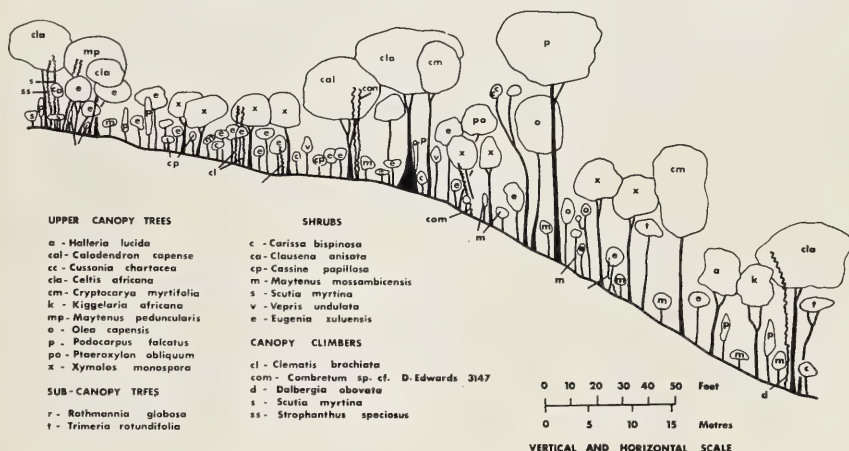


Fig. 6. Profile diagram of Mistbelt Mixed *Podocarpus* Forest on a south-facing slope (belt 300 x 25 ft.).

*capense*, *Celtis africana*, *Podocarpus latifolius*, *Fagara davyi*, *Prunus africanus*, *Podocarpus henkelii*, *Combretum kraussii*, *Xmyalos monospora*, *Kiggelaria africana*, *Halleria lucida*, *Cryptocarya woodii*, *Scolopia mundii*, *Vepris undulata*, *Ficus craterostoma*, *Ekebergia capensis*, *Scolopia zeyheri*, *Apodytes dimidiata*, *Linociera foveolata*, *Rhus chirindensis*, *Maytenus peduncularis*, *Ilex mitis* and *Ocotea bullata*.

Below the upper canopy is a discontinuous subordinate tree layer, 30 to 40 ft. (9 to 12 m) high. This is best developed where the canopy is not particularly dense and species such as *Trimeria rotundifolia*, *Dombeya tiliacea*, *Rothmannia capensis*, *R. globosa*, *Canthium mundianum*, *Pavetta lanceolata* and *Tricalysia lanceolata* occur. Beneath this stratum is another layer of small trees and shrubs, from 6 to 20 ft. (2 to 6 m) high. Common species are *Eugenia zuluensis*, *Maytenus mossambicensis*, *Carissa bispinosa*, *Canthium ciliatum*, *Dovyalis rhamnoides*, *D. zeyheri*, *Diospyros whyteana*, *Peddiea africana*, *Maytenus undata*, *Rinorea angustifolia*, *Englederodaphne pilosa* and *Cassine papillosa*.

In the forest field layer are herbaceous plants up to 4 ft. (1.2 m) high. Wide-spread species are *Oplismenus hirtellus*, *Brachypodium flexum*, *Cyperus albostratus*, *Stipa dregeana*, *Selaginella kraussiana*, *Panicum* spp., and *Diets vegeta*. Common ferns in this layer are *Polystichum amnifolium*, *Cyrtomium caryotideum*, *Adiantum thalictroides* and *Asplenium aethiopicum*.

Lianes are frequent, especially where the canopy has been disturbed. Species are numerous and include *Dalbergia obovata*, *Scutia myrtina*, *Combretum* sp. nov., *Rhoicissus* spp., *Cnestis natalensis*, *Clematis brachiata*, *Strophanthus speciosa*, *Entada spicata* and *Secamone gerrardii*.

The profusion of epiphytes is a characteristic feature of this type. Angiosperms such as *Peperomia reflexa*, *Streptocarpus verecundus*, *Mystacidium* spp. and *Polystachya* spp., and ferns and bryophytes such as *Pleiopeltis* spp., *Asplenium* spp., *Brachymenium pulchrum*, *Leptodon smithii* and *Entodon dregeanus*, occur most frequently on old trees.

(b) Mountain *Podocarpus* Forest occurs in patches on south-facing slopes in the Themeda-Trachypogon Highland Grassland region. This forest is shorter than Mistbelt Mixed *Podocarpus* Forest, having a canopy height of 45 to 60 ft. (14 to 18 m). The forest does not have a large variety of species present and only three strata can be recognized. Structure is shown in a profile diagram (Fig. 7). The continuous upper canopy is rarely pierced by emergent trees. *Podocarpus latifolius* is usually the dominant species, but other common trees are *Euclea crispa*, *Halleria lucida*, *Olinia emarginata*, *Linociera foveolata*, *Fagara davyi*, *Celtis africana*, *Scolopia zeyheri*, *Apodytes dimidiata* and *Prunus africanus*.

Below the canopy there is no definite, shorter tree layer and woody plants present vary greatly in density and in height, from 9 to 40 ft. (3 to 12 m). Common

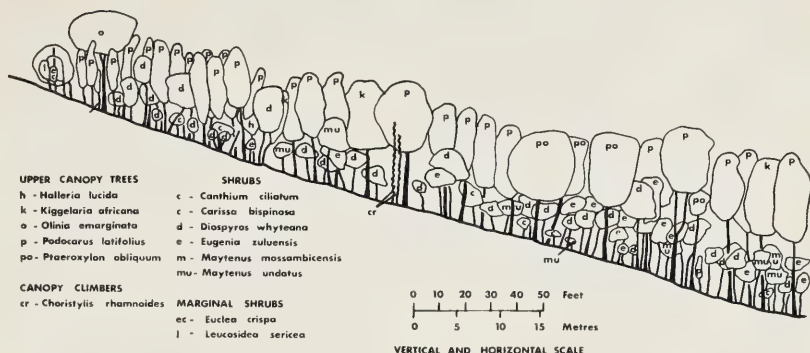


Fig. 7. Profile diagram of Mountain Podocarpus Forest on a southeast-facing slope (belt 300 x 25 ft).

species are *Diospyros whyteana*, *Eugenia zuluensis*, *Canthium ciliatum*, *Dovyalis lucida*, *Maytenus mossambicensis*, *M. undata* and *Carissa bispinosa*.

The herbaceous field layer is more uniform than in Mistbelt Mixed Podocarpus Forest, with *Brachypodium flexum* and *Oplismenus hirtellus* forming a dense sward.

Lianes are infrequent and species occurring are *Choristylis rhamnoides*, *Clematis brachiata*, *Scutia myrtina*, *Cassinopsis ilicifolia* and *Strophanthus speciosa*.

Epiphytes are not numerous and comprise *Peperomia reflexa*, *Streptocarpus* spp. and *Mystacidium* spp.

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#### REFERENCES

- ACOCKS, J. P. H. (1953). Veld Types of South Africa. *Mem. bot. Surv. S. Afr.*, 28.  
 ANON. (1939). *Rainfall Normals*. Government Printer, Pretoria.  
 ANON. (1942). *Climate of South Africa*. Government Printer, Pretoria.  
 ANON. (1954). *Climate of South Africa*. Government Printer, Pretoria.



- BAYER, A. W. (1953). The ecology of grasslands; in *The Grasses and Pastures of South Africa*, Ed. D. Meredith. Johannesburg.
- BEWS, J. W. (1918). *The Grasses and Grasslands of South Africa*. Davis & Sons, Pietermaritzburg.
- DU TOIT, A. L. (1954). *The Geology of South Africa*. Oliver & Boyd, Edinburgh.
- EDWARDS, D. (1967). A Plant Ecological Survey of the Tugela River Basin, Natal. *Mem. bot. Surv. S. Afr.*, **36**.
- KING, L. C. (1951). *South African Scenery*. Oliver & Boyd, Edinburgh.
- MOLL, E. J. (1965). *An account of the Plant Ecology of the Upper Mgeni Catchment*. Unpublished M.Sc. thesis, University of Natal.
- PENTZ, J. A. (1945). Agro-Ecological Survey of Natal. *Soil and Veld Conservation Series*, No. 7. Government Printer, Pretoria.
- TYSON, P. D. (1964). Berg Winds of South Africa. *Weather*, **19**: 7—11.
- WALTER, H. (1963). Climatic diagrams as a means to comprehend the various climatic types for ecological and agricultural purposes; in *The Water Relations of Plants*. Ed. A. J. Rutter and F. N. Whitehead. Brit. Ecol. Soc. Symposium No. 3. Oxford: Blackwells.